TIPEI, N.

Experimental research on sliding bearings. p. 89. STUDII SI CERCETARI DE MECANICA APLICATA. Bucuresti.
Vol. 6, no. 1/2, Jan./June 1956.

SOURCE: East European Acessions List, (EEAL), Library of Congress,
Vol. 5, No. 11, November, 1956.

TIPEL, M.

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Tipel, M. [illegible] Constantinescu [illegible]

TIPEI, N.

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*Tipei, N. Hidro-aerodinamica lubrificatiei. [Hydro-aerodynamics of lubrication.], Biblioteca Ştiinţelor Tehnice, I. Editura Academiei Republicii Populare Romîne, 1957. 695 pp. (1 insert) Lei 37.00.

The present book seems to be the most extensive treatise concerning modern lubrication theory. Also, the book contains a wealth of information about the technical applications of the various theoretical findings, and, where possible the computational results are compared with experimental data.

Furthermore, the author treats lubrication theory in a very general manner. As a matter of fact, the first three chapters (and also some parts of chapter IV) are primarily devoted to the various fundamental notions related to, e.g., the motion of viscous fluids, density and viscosity variations, thermal effects and the estimation of the order of magnitude of the various terms in the non-linear partial differential equations.

Chapter IV is devoted to a study of bearings subject to constant forces and velocities. Typical topics: pressure distribution in journal bearings of infinite elongation, the application of power series, Sommerfeld and Korovcinskii's complex-functional treatment, variational and finite-difference methods for three-dimensional problems. Chapter V is primarily devoted to bearings with no

1/3

radial clearance, pressure determination and global characteristics of bearings with no radial clearance. In chapter VI, the author presents the difficult theory of bearings with variable geometric configurations. Typical topics: pressure determination by means of finite-difference methods, constant and variable clearance with constant and variable radii, global characteristics of bearings with variable elements, plane surfaces with first and second-order discontinuities, lemon bearings, hydrostatic lubrication, lubrication of spherical surfaces, etc. Chapter VII is devoted to bearings subject to variable forces and velocities. Typical topics: plane surfaces of infinite and finite elongation, circular cylindrical surfaces of infinite and finite elongation.

2

In chapter VIII, the author presents results related to the important problem of the stability of motion of lubricated bodies. Typical topics: Plane and circular cylindrical surfaces, centrifugal and constant loads, approximate methods, etc. Chapter IX is devoted to a more general consideration of hydrodynamic lubrication. Typical topics: general power-series solutions (subject to specified hypotheses), dependence of viscosity upon pressure, viscous fluid motion in thick layers, lubrication of rolling circular cylindrical surfaces, boundary-value problems, rates of discharge, etc.

2/3

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Chapter X is devoted to gaseous lubrication. The method of presentation is similar to those of the preceding ones.

In the present book, the author has made a serious attempt to reduce the gap between theory and experiment in lubrication theory. Indeed, this is by no means a simple matter, since the equations to be solved present formidable mathematical difficulties. As a matter of fact, the equations are just as complicated (if not more) as the well-known Navier-Stokes equations of motion of non-linear hydrodynamics. Hence, rigorous solutions of these systems of equations are not feasible at present. These mathematical difficulties are usually circumvented by the omission of various terms in the fundamental equations of motion so as to make the ensuing equations more amenable to approximations. The author enumerates a variety of equations (with varying degrees of accuracy) related to lubrication phenomena. This is an excellent feature of the present book. References are made to a large number of papers and books. However, references to some important works of Leibenzon and Loltyanski are lacking.

Unfortunately, there are many printing errors to be found in this book; some of them also appear in the lists of references.

K. Bhagwandin (Oslo)

3/3

TIPEI, N.; Nica, A.

Boundary conditions in lubrication problems. p. 63.
(STUDII SI CERCETARI DE MECANICA APLICATA. Vol. 8, no. 1, Jan/Mar. 1957, Bucuresti, Rumania)

SO: Monthly List of East European Accessions (EEAL) LC. Vol. 6, No. 12, Dec. 1957. Uncl.

TIPEI, N.

Lubrication of cylindrical surfaces during rolling and sliding motion. p. 1039.

Academia Republicii Populare Romine. Institutul de Mecanica Aplicata. STUDII SI CERCETARI DE MECANICA APLICATA. Bucuresti, Rumania. Vol. 8, no. 4, 1957.

Monthly list of East European Accessions (EEAI) LC, Vol. 8, no. 8, Aug. 1959

Uncl.

TIPEY, N.

PHASE I BOOK EXPLOITATION SOV/5055

Vsesoyuznaya konferentsiya po treniyu i iznosu v mashinakh. 3d, 1958.

Gidrodinamicheskaya teoriya smazki. Opory skol'zheniya. Smazka i smazochnyye materialy (Hydrodynamic Theory of Lubrication. Slip Bearings. Lubrication and Lubricant Materials) Moscow, Izd-vo AN SSSR. 422 p. Errata slip inserted. 3,800 copies printed. (Series: Its: Trudy, v. 3)

Sponsoring Agency: Akademiya nauk SSSR. Institut mashinovedeniya. Resp. Eds. for the Section "Hydrodynamic Theory of Lubrication and Slip Bearings": Ye. M. Gut'yar, Professor, Doctor of Technical Sciences, and A. K. D'yachkov, Professor, Doctor of Technical Sciences; Resp. Ed. for the Section, "Lubrication and Lubricant Materials": G. V. Vinogradov, Professor, Doctor of Chemical Sciences; Ed. of Publishing House: M. Ya. Klebanov; Tech. Ed.: O. M. Gus'kova.

PURPOSE: This collection of articles is intended for practicing engineers and research scientists.

COVERAGE: The collection, published by the Institut mashinovedeniya AN SSSR (Institute of Science of Machines, Academy of Sciences USSR) contains papers presented at the III Vsesoyuznaya konferentsiya po treniyu i iznosu v mashinakh (Third All-Union Conference on Friction and Wear in Machines) which was held April 9-15, 1958. Problems discussed were in

Hydrodynamic Theory (Cont.) SOV/5055

~~Card 3/1~~7

Tipei, N. ; Guta, C.

Motion of an airplane upon a given trajectory. p. 855.

Academia Republicii Populare Romine. STUDII SI CERCETARI DE MECANICA APLICATA. Bucuresti, Rumania. Vol. 9, no. 4, 1958.

Monthly List of East European Accessions (EEAL) LC Vol. 9, No. 2, January 1960.

Uncl.

TIPEI, N.; NICA, A.

Research on the working conditions of bearings. I. Influence of the variation of viscosity. p.737

STUDII SI CERCETARI DE MECANICA APLICATA. Academia Republicii Populare Romine
Bucuresti, Rumania
Vol. 10, no.3, 1959

Monthly List of East European Accessions (EEAI) LC., Vol. 9, no.1, Jan. 1960
Uncl.

TIPEI, N.; NICA, A

Conditions of lubricating oils supply and their influence on the functioning of journal bearings. p.844

METALURGIA SI CONSTRUCTIA DE MASINI. (Ministerul Industriei Metalurgice si Constructiilor de Masins si Asociatia Stiintifica a Inginerilor si Technicienilor din Rominia) Bucuresti, Rumania
Vol. 11, no.10 Oct. 1959

Monthly list of East European Accessions (EEAI) LC Vol.9, no.2, Feb. 1960

Uncl.

R/008/60/000/004/006/018
A125/A126

AUTHOR: Tipei, N.

TITLE: The two-dimensional problem of incompressible turbulent lubrication in case of variable viscosity

PERIODICAL: Studii şi Cercetări de Mecanică Aplicată, no. 1960, 883 - 891

TEXT: The article presents some solutions to the problem of pressure distribution for plane or circular cylindrical surfaces. Considering the equation of $\bar{p}$ average pressures in two-dimensional motion, the pressures are expressed by:

$$\bar{p}_{\infty} = 6V \int \frac{\mu}{h^2} \left(1 - \frac{h_0}{h}\right)\left[1 + 0.01167 \mathcal{R}^{*0.725}\left(\frac{h}{h_1}\right)^{0.725\,(1-q)}\right] dx_1 + C_2, \quad (1),$$

in which h is the thickness of the fluid film, $V = V_{11} + V_{21}$, the sum of the velocities of the two surfaces along the direction of the x_1 axis, μ the viscosity, $\mathcal{R}^* = \frac{\sigma^{*2}}{0.16} \frac{\rho V h_1}{1}$; h_1 the maximum thickness of the film, μ_1 the visco-

Card 1/3

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The two-dimensional problem of ....

in the point $h = h_1$, ρ the density, and $\delta^* = \pm \left(\frac{dl^*}{dx_2}\right)_{\substack{x_1=0 \\ x_2=h}}$, the value at the wall

of the derivative of the mixture length. The exponent

$$q = \frac{\ln\left(\frac{\mu}{\mu_1}\right)}{\ln\left(\frac{h}{h_1}\right)}; \tag{2}$$

is included between zero and unity, and determines the variation law of μ with the point through the intermediate of h. $\bar{p}_\infty$ can be connected to the solution of p_{∞_l} for the laminary case, i.e.,

$$\bar{p}_\infty = p_{\infty_l} + \frac{0.07 \; \mu_1 V \mathcal{R}^{*0.725}}{h_1^{0.725 + 0.275\,q}} \int \frac{1}{h^{1.275 - 0.275\,q}} \; 1 - \frac{h_0}{h} \; dx_1 + C_2, \tag{3}$$

in which the velocity V, and if $q = 1$, one finds all results of the laminar case,

Card 2/3

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A125/A126

The two-dimensional problem of ....

however, is multiplied by the ration (4). The author then examines the plane surfaces and determines that the pressure values increase with $\mathcal{R}e^*$, but the behaviour of the curves remain the same. The same observation can be made for ξ_∞, which was represented in function of $\frac{h_1}{h_2}$, according to V. N. Constantinescu (Ref. 2: Calculul lagărelor compuse din suprafețe plane, lubrificate în regim turbulent. Studii și cercetări de mecanică aplicată, 3, 755 - 770, 1959). The author finally shows that for circular cylindrical surfaces the trajectory of the shaft axle is less influenced by the viscosity variation than in laminar flow. Theoretical results show a good egreement with experimental data. There are 5 figures and 3 Soviet-bloc references.

SUBMITTED: February 17, 1960

Card 3/3

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AUTHORS: Tipei, N., and Constantinescu, V.N.

TITLE: Generalization of the Reynolds equation in the study of lubrication under turbulent conditions

PERIODICAL: Studii şi cercetări de mecanică aplicată, no. 2, 1960, 359-363

TEXT: The authors deduce in the present article the pressure equation in the case of lubrication under turbulent conditions. Considering an orthogonal system of $Ox_1x_2x_3$ axes in such a way that Ox_1, x_3 may expand over a solid surface (1), and that Ox_2 is the normal to it, the equations of the turbulent motion of a fluid can be deduced between one solid surface (1) and another solid surface (2) located at a very small distance h, and variable with the point against the first surface. With $\bar{p}$, $\bar{v}_1$ - pressure and veloci-

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Card 1/10

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D246/D303

ty according to the Ox_i medium axis, V_{1i}, V_{2i} $(i = 1, 2, 3)$ - components of the absolute velocities of surfaces (1) and (2), μ - dynamic viscosity, and v_{im} - expression

$$v_{im} = \frac{1}{h}\int_0^h \bar{v}_i \, dx_2 \tag{1}$$

V.N. Constantinescu (Ref. 1: Studiul lubrificației bidimensionale în regim turbulent (Studies on Bidimensional Lubrification under Turbulent Conditions) Studii și cercetări de mecanică aplicată, IX, 1, 139-162, 1958) established the component of the pressure gradient on Ox_1:

$$\frac{\partial \bar{p}}{\partial x_1} = -\left[12 + 0.16\left(\frac{\delta^{*2}}{0.16}\mathcal{R}e\right)^{0.725}\right]\frac{\mu}{h^2}\left(v_{1m} - \frac{V_{11} + V_{21}}{2}\right), \tag{2}$$

In this relation $\pm\ \delta^* = \left(\frac{dl^*}{dx_2}\right)_{\substack{x_2 = 0 \\ x_2 = h}}$, ($l^*$ = mixture length), and

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Generalization of the Reynolds ...

R_e (the Reynolds number) $= \frac{\rho V h}{\mu}$; $(V = V_{11} + V_{21})$. Selecting axis Ox_1 so that it is included in the plane of the relative motion and the normal Ox_2 is on surface (1) $V_{13} + V_{23} = 0$, and

$$\frac{\partial \bar{p}}{\partial x_3} = \pm \left(12 + 0.103 R_e^{0.745}\right) \frac{\mu}{h^2 V^{0.089} R_e^{0.18}} / v_{3m} /^{1+0.089 R_e^{0.18}}. \quad (3)$$

Since ρ can be considered invariable on a normal surface, the authors establish the following expression:

$$\int_0^h \frac{\partial}{\partial x_i} (\rho \bar{v}_i)\, dx_2 = \frac{\partial}{\partial x_i} \int_0^h (\rho \bar{v}_i)\, dx_2 - \rho V_{2i} \frac{\partial h}{\partial x_i} = \frac{\partial}{\partial x_i} (\rho h v_{im}) - \rho V_{2i} \frac{\partial h}{\partial x_i}. \quad (4)$$

Integrating the continuity equation between 0 and h, they obtain

$$-\int_0^h \left(\frac{\partial (\rho \bar{v}_1)}{\partial x_1} + \frac{\partial (\rho \bar{v}_3)}{\partial x_3}\right) dx_2 = \rho (V_{22} - V_{12}) + h \frac{\partial \rho}{\partial t}, \quad (5)$$

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Card 3/10

or considering (1) and (4)

$$-\frac{\partial}{\partial x_1}(\rho h v_{1m}) - \frac{\partial}{\partial x_3}(\rho h v_{3m}) = \rho(V_{22} - V_{12}) + h\frac{\partial \rho}{\partial t} - \qquad (6)$$

$$- \rho\left(V_{21}\frac{\partial h}{\partial x_1} + V_{23}\frac{\partial h}{\partial x_3}\right). \qquad (6)$$

Introducing then the values of the medium velocities given by formulae (2) and (3), the pressure equation under turbulent conditions is obtained:

$$\frac{\partial}{\partial x_1}\left(\frac{h^3\rho}{\mu k_1}\frac{\partial p}{\partial x_1}\right) \pm \frac{\partial}{\partial x_3}\left[\left(\frac{h^2 V^{n_3-1}}{\mu k_3}\left|\frac{\partial p}{\partial x_3}\right|\right)^{\frac{1}{n_3}}\rho h\right] = \rho(V_{22} - V_{12}) + \qquad (7)$$

$$+ \frac{1}{2}\frac{\partial}{\partial x_1}[\rho h(V_{11} + V_{21})] - \rho\left(V_{21}\frac{\partial h}{\partial x_1} + V_{23}\frac{\partial h}{\partial x_3}\right) + h\frac{\partial \rho}{\partial t}, \qquad (7)$$

33044 R
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Generalization of the Reynolds ...

$$k_1 = 12 + 0{,}14\left(\frac{\sigma^{*2}}{0{,}16}\mathfrak{R}_e\right)^{0{,}725}, \quad k_3 = 12 + 0{,}103\left(\frac{\sigma^{*2}}{0{,}16}\mathfrak{R}_e\right)^{0{,}745},$$
$$n_3 = 1 + 0{,}089\left(\frac{\sigma^{*2}}{0{,}16}\mathfrak{R}_e\right)^{0{,}18}. \qquad (7)$$

In this equation + is taken for $\frac{\partial p}{\partial x_3} > 0$ and vice versa. The second member of the preceding relation is identical with the one which appears in the pressure equation for laminar lubricating conditions. Since it is fairly difficult to apply Eq. (7), a linear connection between $\frac{\partial p}{\partial x_3}$ and v_{3m} may be admitted in fields having not too great a pressure ($p < 50$ kg/cm^2):

$$\frac{\partial p}{\partial x_3} = -\left[12 + 0{,}0897\left(\frac{\sigma^{*2}}{0{,}16}\mathfrak{R}_e\right)^{0{,}65}\right]\frac{\mu}{h^2}v_{3m}. \qquad (8)$$

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Card 5/10

On the basis of this relation, the authors establish from (6):

$$\left.\begin{aligned}&\frac{\partial}{\partial x_1}\left(\frac{h^3\rho}{\mu k_1}\frac{\partial p}{\partial x_1}\right)+\frac{\partial}{\partial x_3}\left(\frac{h^3\rho}{\mu k_3}\frac{\partial p}{\partial x_3}\right)=\rho(V_{22}-V_{12})+\\&+\frac{1}{2}\frac{\partial}{\partial x_1}[(\rho h(V_{11}+V_{21})]-\rho\left(V_{21}\frac{\partial h}{\partial x_1}+V_{23}\frac{\partial h}{\partial x_3}\right)+h\frac{\partial\rho}{\partial t},\\&k_3=12+0{,}0897\left(\frac{\sigma^{*2}}{0{,}16}\Re_e\right)^{0{,}65}.\end{aligned}\right\}\ (9) \qquad (9)$$

This formula is much similar to the pressure equation in laminar conditions than (7). Its application field determined by the maximums and minimums of the pressures is smaller; it can be used, however, for all variations of p. The authors then consider ρ = constant, i.e. a lubrification with liquids. Considering a variation law of the viscosity, as shown by N. Tipei (Ref. 2: Hidro-aerodinamica lubrificației (Hydro-Aerodynamics of Lubrification), Ed.

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D246/D303

Generalization of the Reynolds ...

Acad. R.P.R., 1957), having the shape

$$\mu = \mu_1 \left(\frac{h}{h_1}\right)^q \qquad (10)$$

in which h_1 is the maximum thickness of the fluid film, the Reynolds number becomes constant for the whole lubrifying layer if $q = 1$.

$$\left.\begin{aligned} \mathfrak{R}_e &= \frac{\rho V h}{\mu} = \frac{\rho V h^{1-q} h_1^q}{\mu_1}, \\ \mathfrak{R}_{e_{q=1}} &= \frac{\rho V h_1}{\mu_1} = \text{const.}, \end{aligned}\right\} \qquad (11) \qquad (11)$$

and thus k_1 and k_3 do not vary with the point. Using the variable changes as shown by V.N. Constantinescu (Ref. 4: Consideraţii asupra lubrificaţiei tridimensionale în regim turbulent (Considerations on Tridimensional lubrification under Turbulent Conditions)

Card 7/10

33044 R

Generalization of the Reynolds ... R/008/60/000/002/003/C07
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Studii şi cercetări de mecanică aplicată, X, 4, 1959)

$$\tilde{x}_3 = \sqrt{\frac{k_3}{k_1}}\, x_3, \qquad \tilde{V}_{ij} = \frac{k_1}{12}\, V_{ij}, \tag{12}$$

The authors determine from (9), if V_{ij} does not depend on x_3:

$$\frac{\partial}{\partial x_1}\left(\frac{h^2 h_1}{12\,\mu_1}\frac{\partial p}{\partial x_1}\right) + \frac{\partial}{\partial \tilde{x}_3}\left(\frac{h^2 h_1}{12\,\mu_1}\frac{\partial p}{\partial \tilde{x}_3}\right) = \tilde{V}_{22} - \tilde{V}_{12} + \frac{h}{2}\frac{\partial}{\partial x_1}(\tilde{V}_{11} + \tilde{V}_{21}) + \frac{1}{2}(\tilde{V}_{11} - \tilde{V}_{21})\frac{dh}{dx_1}, \tag{13}$$

i.e. the lubrication equation in laminar conditions, but in ratio with the variables x_1 and x_3 and for velocities $\tilde{V}_{ij}$. Everything proceeds as if elongation would suffer a modification $\tilde{\lambda} = \sqrt{\frac{k_3}{k_1}}\,\lambda$, and velocities are amplified by $\frac{k_1}{12} > 1$. Using these

Card 8/10

33044 R
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observations, all results of the laminar state may also be used for turbulent lubrification (Ref. 2: Op.cit.). For $q \neq 1$, Eqs. (7) and (9) are difficult to solve, even where the density does not vary. Generally it may occur that in certain states of motion, sections exist in which $\mathcal{R}e > \mathcal{R}e_c$ and in other sections $\mathcal{R}e < \mathcal{R}e_c$. In the case of a plane motion, however, if the flow no longer depends on x_3 and designating h_0 the thickness at the point where the pressure has maximum value by applying the continuity law, there results:

$$\rho h v_{1m} = \frac{1}{2} \rho_0 h_0 V \qquad (14)$$

and subsequently the effective Reynolds number

$$\mathcal{R}e_e = \frac{\rho v_{1m} h}{\mu} = \frac{\rho_0 h_0 V}{2\mu} \qquad (15)$$

For a constant viscosity, $\mathcal{R}e_e$ = const. This shows that the motion becomes turbulent in the whole fluid layer if $2\mathcal{R}e_e \geqslant \mathcal{R}e_c$, as

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Generalization of the Reynolds ...

shown by V.N. Constantinescu (Ref. 3: Consideraţii asupra lubrificaţiei cu gaze în regim turbulent (Considerations on Gas Lubrication in Turbulent Conditions) Studii şi cercetări de mecanică aplicată, IX, 2, 369-376, 1958). There are 4 Soviet-bloc references. /Abstractor's note: This is essentially a complete translation/.

SUBMITTED: February 10, 1960

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Card 10/10

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A125/A026

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AUTHOR: Tipei, N.

TITLE: Three-Dimensional Lubrication of Surfaces of Small Extent at High Speeds

PERIODICAL: Studii şi Cercetări de Mecanică Aplicată, 1960, No. 3, pp. 595-601

TEXT: Subject article deals with the three-dimensional lubrication of bearing. The author first establishes the equation of pressures, expressed by the relation (1). Considering that $\lambda = \frac{b}{2r_1}$, i.e., the ratio between the width of the common zone of the surfaces has small values and the coordinating axes are selected in such a way that the Ox_1x_2 plane becomes the mean plane of the active zone, parallel to V; the pressure equation can now be expressed by the relation (4). In this equation the viscosity was supposed to be variable with the Law $\mu = \mu_1 \left(\frac{h}{h_1}\right)^q$, (5), (Refs. 1,2). In case the pressure variation is not too great, the equation (4) obtaines a shape more simple. Also admitting that $p > p_o$ on the portion where $\frac{dh}{dx_1} < 0$, the factor: sign $\left(\frac{dh}{dx_1}\right)$ of the equation (4) can be replaced by –. The author then examines two particular cases: 1) Linear variation of the thickness of the film: Introducing the expression (7) into (4), the

Card 1/ 3

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Three-Demensional Lubrication of Surfaces of Small Extent at High Speeds

pressure equation for q = 0 can be expressed by the relation (8). The behavior of pressures in the mean plane is that of Figure 1, and $\bar{p} = p_0$ at the beginning and ending of the active zone. The overall bearing capacity is finally given by the relation (11). If the surfaces are very long and the width b is different from 0, it results for $\lambda \rightarrow 0$, $x_1 \rightarrow \infty$, $h_1 \rightarrow \infty$, and with that at the limit: $\zeta = \frac{k_3 \lambda^2}{48}$, (12). For the laminary region $k_3 = 12$, the author obtains $\zeta = \frac{\lambda^2}{4}$, a value which has been calculated by Michell for this case. 2) Circular cylindrical surfaces: The author deduces the equations for the coefficients corresponding to the components of the P_{po} pressure resultants according to the center line Ct, and the normal line Cn, finally expressed by (14); the moment coefficients on the spindle or bearing (Cm_1 and Cm_2), (17); and the lubricant delivery in a certain section according to the directions x_1 (Q_{x_1}) or x_3 (Q_{x_3}), (18). These formulae can be applied for all surfaces. For cylindrical annular bearings, the delivery coefficients in the entering and exit section, the delivery coefficients, and the coefficients referring to the lateral escape can be deduced immediately, and are expressed by the relation (19). The position of the center lines against the direction of the load defined by the angle σ, as well as the

Card 2/3

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Three-Dimensional Lubrication of Surfaces of Small Extent at High Speeds

coefficient ζ of the bearing capacity are expressed by (20). The above-mentioned relations allow the calculation of bearings lubricated in turbulent and laminary conditions by the same method. The bearing capacity is considerably increased by the appearance of the turbulence. There are 1 figure and 3 Rumanian references.

SUBMITTED: February 10, 1960

Card 3/3

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A231/A126

AUTHORS: Tipei, N., and Constantinescu, V. N.

TITLE: The influence of the variation law of the mixture length on the turbulent motion in the lubricating layer

PERIODICAL: Studii şi Cercetări de Mecanică Aplicată, no. 5, 1960, 1091-1101

TEXT: The authors examine the influence of the variation law of the mixture length on the distribution speeds in a lubricating layer. The motion is considered along an axis between two neighbouring walls of an arbitrary shape. In case the flow within the lubricating layer is turbulent, the motion equation can be expressed by the equation system

$$\frac{\partial \bar{p}}{\partial x_1} = \mu \frac{\partial^2 \bar{v}_1}{\partial x_2^2} + \frac{\partial}{\partial x_2} (-\rho \overline{v_1' v_2'}),$$
$$\frac{\partial \bar{p}}{\partial x_2} = \frac{\partial}{\partial x_2} (-\rho \overline{v_2'^2}), \qquad (1)$$
$$\frac{\partial \bar{p}}{\partial x_3} = \mu \frac{\partial^2 \bar{v}_3}{\partial x_2^2} + \frac{\partial}{x_2} (-\rho \overline{v_2' v_3'}),$$

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Card 1/8

The influence of the variation law of...

where p is the pressure, μ the viscosity, ρ the density of the lubricant, v_1, v_2, v_3 the speed components and x_1, x_2, x_3 the coordinate axes. The second equation of the system (1) gives the pressure distribution according to the normal of the lubricating layer, whereas the first and the third equations control the speed distribution, requiring the knowledge of the turbulent stresses $\overline{v_1'v_2'}$, $\overline{v_2'}^2$, $\overline{v_2'v_3'}$. Due to the low thickness of the lubricating layer, the turbulent stresses can be determined by using the hypothesis of the mixture length of Prandtl. After considering several hypotheses, the authors deduce from the first equation of the system (1) the equation

$$\sigma^{*2} \mathcal{R}e \frac{1^{*2}}{\delta^2} \frac{\partial \bar{v}_1}{\partial \bar{x}_2} \left|\frac{\partial \bar{v}_1}{\partial \bar{x}_2}\right| + \frac{\partial \bar{v}_1}{\partial \bar{x}_2} - \frac{\delta^2}{\mu V} \frac{\partial p}{\partial x_1} \bar{x}_2 - C = 0, \qquad (5)$$

which has previously been integrated, considering a linear variation of the mixture length

$$\bar{1}^* = \frac{1^*}{\delta} = \bar{x}_2 \qquad \left(0 < x_2 \leq \frac{\delta}{2}\right), \qquad (8)$$

$$\bar{1}^* = \frac{1^*}{\delta} = 1 - \bar{x}_2 \qquad \left(\frac{\delta}{2} \leq x_2 \leq \delta\right),$$

The hypothesis of the linear variation of the mixture length requires a di-

vision of the thickness of the lubricating layer into two equal portions, in which the length l has different variations, the two straight lines intersecting each other at $x_2 = \frac{\delta}{2}$. This pressure however, is only an approximation. In order to appreciate this error, the authors admit a trigonometric and a parabolic variation law

$$\bar{I}^* = \frac{1}{\pi}\sin\pi\bar{x}_2, \qquad (9)$$

or

$$\bar{I}^* = \bar{x}_2(1-\bar{x}_2), \qquad (10)$$

selected in such a way that the derivative $\left(\frac{\partial \bar{I}^*}{\partial \bar{x}_2}\right)_{\bar{x}_2=0} = \lambda^*$ should have the same value. Designating with x_2^* in (5) the point in which the speed v_1 presents a maximum or a minimum, the C constant will be equal with

$$C = -\frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1}\frac{x_2^*}{\delta} = -\frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1}\bar{x}_2^* \qquad (12)$$

and the speed derivative on both sides with

$$\left(\frac{\partial \bar{v}_1}{\partial \bar{x}_2}\right)_{\bar{x}_2=0} = C = -\frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1}\bar{x}^*; \quad \left(\frac{\partial \bar{v}_1}{\partial \bar{x}_2}\right)_{\bar{x}_2=1} = \frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1} + C = \frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1}(1-\bar{x}_2^*). \qquad (13)$$

X

Card 3/8

Substituting x_2^* for C, the equation (5) can then be written in the form of

$$\sigma^{*2} \mathfrak{K}_* \bar{l}^{*2} \frac{\partial \bar{v}_1}{\partial \bar{x}_2} \left| \frac{\partial \bar{v}_1}{\partial \bar{x}_2} \right| + \frac{\partial \bar{v}_1}{\partial \bar{x}_2} - \frac{\delta^2}{\mu V} \frac{\partial p}{\partial x_1} (\bar{x}_2 - \bar{x}_2^*) = 0, \qquad (15)$$

In general cases, the equations (5) and (15) can be expressed by

$$\frac{\partial \bar{v}_1}{\partial \bar{x}_2} = \mp \frac{1 - \sqrt{1 \pm 4\sigma^{*2} \mathfrak{K}_* \bar{l}^{*2} \left(C + \frac{\delta^2}{\mu V} \frac{\partial p}{\partial x_1} \bar{x}_2 \right)}}{2\sigma^{*2} \mathfrak{K}_* l^{*2}}, \qquad (16)$$

The integral equation of $\overline{v_1}$,

$$\bar{v}_1 = \mp \int \frac{1 - \sqrt{1 \pm 4\sigma^{*2} \mathfrak{K}_* \bar{l}^{*2} \left(C + \frac{\delta^2}{\mu V} \frac{\partial p}{\partial x_1} \bar{x}_2 \right)}}{2\sigma^{*2} \mathfrak{K}_* \bar{l}^{*2}} d\bar{x}_2 + C_2. \qquad (17)$$

is easily calculated in case of $\frac{p}{x_1} = 0$ (a Couette motion). For a linear variation of l*, the respective expressions have been deduced by V. N. Constantinescu (Ref. 1: V. N. Constantinescu, Influenta turbulentei asupra miscarii in stratul de lubrifiant. Studii si cercetari de mecanica aplicata, IX, 1, 103, 1958). In case of a trigonometrical variation, the final solu-

tion of $\overline{v_1}$ is given by

$$\bar{v}_1 = \frac{\pi}{2\sigma^{*2} R_*}\left\{\frac{1}{\mathrm{tg}\,\pi\bar{x}_2} - \frac{1}{\sqrt{1-k^2}}\left\{\frac{\sqrt{1-k^2\cos^2\pi\bar{x}_2}}{\mathrm{tg}\,\pi\bar{x}_2} + F\left[\pi\left(\frac{1}{2}-\bar{x}_2\right), k\right] - \right.\right.$$

$$\left.\left. - F\left(\frac{\pi}{2}, k\right) - E\left[\pi\left(\frac{1}{2}-\bar{x}_2\right), k\right] + E\left(\frac{\pi}{2}, k\right)\right\}\right\}. \qquad (24)$$

In order to establish the influence of the law on the connections between the lubricant discharge and $\frac{\partial p}{\partial x_1}$, the authors study the general case of $\frac{\partial p}{\partial x_1} = 0$. Considering $\varkappa^2 \bar{\delta}_1^2 \frac{\partial \bar{v}_1}{\partial \bar{x}_2}\left|\frac{\partial \bar{v}_1}{\partial \bar{x}_2}\right|$ negligible for $0 \leq \bar{x}_2 \leq \delta_1$, and $(1-\delta_2) \leq \bar{x}_2 \leq 1$, they deduce the approximation

$$\frac{\partial \bar{v}_1}{\partial \bar{x}_2} = \pm \frac{1}{\sigma^* \sqrt{R_*}} \frac{\sqrt{\pm\left(C + \frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1}\bar{x}_2\right)}}{\bar{l}^*}$$

$$= \pm \frac{1}{\sigma^* \sqrt{R_*}} \frac{\sqrt{\left|\frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1}\right|}\sqrt{\bar{x}_2 - \bar{x}_2^*}}{\bar{l}^*}. \qquad (27)$$

X

which requires the existence of a laminar boundary layer in the vicinity of

The influence of the variation law of...

the walls. The various solutions of the equation (27) are given by:

$$\left.\begin{array}{ll}
(\bar{v}_1)_{\varepsilon_1 < \bar{x}_1 < \bar{x}_2^*} = & \\
= \dfrac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{-\dfrac{\delta^2}{\mu V} \dfrac{\partial p}{\partial x_1} C_1} \left[I_1 + 2 \sqrt{\dfrac{1}{C_1} - 1}\, I_3 \right] + \bar{v}_2^* & 0 < C_1 = \bar{x}_2^* < 1, \\
(\bar{v}_1)_{\bar{x}_2^* < \bar{x}_1 < 1 - \varepsilon_1} = & \\
= -\dfrac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{-\dfrac{\delta^2}{\mu V} \dfrac{\partial p}{\partial x_1} C_1} \left[-2 I_2 + \sqrt{\dfrac{1}{C_1} - 1}\, I_4 \right] + \bar{v}_1^* & \dfrac{\partial p}{\partial x_1} < 0, \\
(\bar{v}_1)_{\varepsilon_1 < \bar{x}_1 < \bar{x}_2^*} = & \\
= -\dfrac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{\dfrac{\delta^2}{\mu V} \dfrac{\partial p}{\partial x_1} C_1} \left[-I_1 + 2 \sqrt{\dfrac{1}{C_1} - 1}\, I_3 \right] + \bar{v}_1^* & 0 < C_1 = \bar{x}_2^* < 1, \\
(\bar{v}_1)_{\bar{x}_2^* < \bar{x}_1 < 1 - \varepsilon_1} = & \\
= \dfrac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{\dfrac{\delta^2}{\mu V} \dfrac{\partial p}{\partial x_1} C_1} \left[-2 I_2 + \sqrt{\dfrac{1}{C_1} - 1}\, I_4 \right] + \bar{v}_1^* & \dfrac{\partial p}{\partial x_1} > 0,
\end{array}\right\} \quad (28)$$

Card 6/8

22243
The influence of the variation law of... R/008/60/000/005/001/014
A231/A126

Equation (28): (continued)

$$\bar{v}_1 = \frac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{-\frac{\delta^2}{\mu V}\frac{\partial p}{\partial x_1} C_1}\left[I_1 + \sqrt{1 - \frac{1}{C_1} I_4}\right] + \bar{v}_1^*;$$

$$C_1 > 1, \frac{\partial p}{\partial x_1} < 0, \quad C_1 < 0, \frac{\partial p}{\partial x_1} > 0,$$

$$\bar{v}_1 = -\frac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{\frac{\delta^3}{\mu V}\frac{\partial p}{\partial x} C_1}\left[-I_1 + \sqrt{1 - \frac{1}{C_1} I_4}\right] + \bar{v}_1^*;$$

$$C_1 < 0, \frac{\partial p}{\partial x_1} < 0, \quad C_1 < 1, \frac{\partial p}{\partial x_1} > 0,$$

$$\bar{v}_1 = \pm \frac{1}{\sigma^* \sqrt{\mathfrak{R}_*}} \sqrt{\frac{\delta}{\mu V} C_1'} \ln \frac{\bar{x}_2}{1 - \bar{x}_2} + \frac{1}{2}; \quad \frac{\partial p}{\partial x_1} = 0, \; C_1' = \frac{\partial p}{\partial x_1} \delta C_1,$$

The variation law of the mixture length has little influence on the behaviour of the speed distribution in the lubricating layer. But, it has great influence on the pressure distribution and the values of the friction forces

Card 7/8

22243
S/008/60/000/005/001/014
A231/A126

The influence of the variation law of...

on both lubricated surfaces. The linear variation law is more accurate than the parabolic law. There are 4 figures and 4 references: 3 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: T. Laufer, Some Recent Measurements in a Two-Dimensional Turbulent Chanel, Journal of Aeronautical Sciences, 17, 277, 1950.

SUBMITTED: April 2nd, 1960

Card 8/8

TIPEI, N., conf.; CONSTANTINESCU, V.N.; NICA, Al.

Computing journal bearings. Studii cerc mec apl 11 no.6:1377-1395 '60.

1. Institutul politehnic, Bucuresti. Membru al Comitetului de redactic, "Studii si cercetari de mecanica aplicata" (for Tipei).

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10.6200 also 1327, 1121, 1502, 1103

R/008/61/000/001/001/011
D237/D301

AUTHORS: Tipei, N., and Constantinescu, V.N.

TITLE: The phugoid paths of high-speed aircraft

PERIODICAL: Studii şi cercetări de mecanică aplicată, no. 1, 1961, 11 - 26

TEXT: The authors define various phugoid motions in the compressibility range, establishing some very general cases which are possible in the range of sonic speed. The authors admit that thrust is equal to drag and the moments around the aircraft are at all times equal to zero. Under these conditions, the angle of attack of the elevator settings and the fuel admission α vary with the Mach number M and the altitude z. Considering S to be the wing surface, ρ the density, and a the speed of sound at the corresponding altitude, relation

$$\mathscr{F}(\alpha, \rho, M) = S\frac{\rho}{2}a^2M^2C_x(M) \quad (3) \qquad (3)$$

Card 1/15

23027

R/008/61/000/001/001/011
D237/D301

The phugoid paths of ...

may be established, where from α can be obtained. [Abstractor's note: C_x is the drag coefficient]. With V = aM speed of the aircraft, P - the lift and r - the curvature radius of the trajectory, the forces which act in the center of gravity G of the solid are represented in Fig. 1, in which G is the aircraft's weight and the angle of the trajectory with the horizontal line.

Fig. 1.

Legend: 1 - Reference line; 2 - center of curvature; 3 - trajectory; 4 - horizontal.

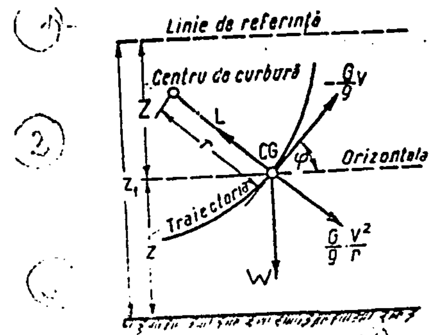

Fig. 1

Card 2/15

If z_1 is the altitude at which V = 0, and where $Z = z_1 - z$, the theory of the phugoid motions immediately supplies

$$a^2 M^2 = 2gZ \qquad (4)$$

Z^*, V^*, ρ^*, a^*, and M^* are the values corresponding to Z, V, ρ, a and M at a horizontal, rectilinear and uniform flight altitude with the same deviation ß of the elevator. Since ρ and a depend on z and Z, respectively, the relation of cos φ may be written by:

$$\cos\varphi = \frac{1}{2\rho^* Z^* C_z^*} \frac{1}{\sqrt{Z}} \int \rho \sqrt{Z}\, C_z\left(\frac{Z}{a^2}\right) dZ + \frac{k}{\sqrt{Z}}. \qquad (7)$$

Admitting for subsonic flight the Prandtl-Glauert law, the lift coefficient will be expressed by

$$C_z = C_z^* \frac{\sqrt{1 - M^{*2}}}{\sqrt{1 - M^2}} = C_z^* \frac{\sqrt{1 - \frac{2g}{a^{*2}} Z^*}}{\sqrt{1 - \frac{2g}{a^2} Z}}. \qquad (9)$$

Card 3/15

and admitting for supersonic flights the Ackeret formula, the authors obtain

$$C_z = C_z^* \frac{\sqrt{M^{*2}-1}}{\sqrt{M^2-1}} = C_z^* \frac{\sqrt{\frac{2g}{a^{*2}}Z^* - 1}}{\sqrt{\frac{2g}{a^2}Z - 1}}, \quad (11) \qquad (11)$$

in which $a = a^*$ can approximately be taken. In the case of subsonic flights, formula (7) can now be written as

$$\cos\varphi = \frac{\sqrt{1 - \frac{2g}{a^2}Z}}{Z^* \sqrt{Z}} \int \frac{1}{\sqrt{\frac{Z}{1 - \frac{2g}{a^2}Z}}} dZ + \frac{k}{\sqrt{Z}} \qquad (12)$$

and if the altitude variations are not too great, so that ρ may be considered constant, as

$$\cos\varphi = -\frac{\sqrt{1-\frac{2g}{a^2}Z}}{Z\sqrt{Z}}\,\frac{a^2}{2g}\left(\sqrt{Z\left(1-\frac{2g}{a^2}Z\right)}+\sqrt{\frac{a^2}{2g}}\,\mathrm{arc\,tg}\sqrt{\frac{a^2}{2gZ}-1}\right)+\frac{k}{\sqrt{Z}}. \quad (13)$$

The radius of the trajectory's curvature is expressed by

$$\frac{1}{r} = \frac{1}{2Z}\left(\frac{\rho Z\, C_z(\frac{Z}{a^2})}{\rho^* Z^* C_z^*} - \cos\varphi\right) = \quad (16)$$

$$= \frac{1}{2Z}\left\{\frac{1}{\rho^* Z^* C_z^*}\left[\rho Z\, C_z(\frac{Z}{a^2}) - \frac{1}{2\sqrt{Z}}\int\rho\sqrt{Z}\, C_z(\frac{Z}{a^2})\,dZ\right] - \frac{k}{\sqrt{Z}}\right\},$$

whence the trajectory can be deduced, obtaining

$$\int\frac{p\,dp}{(1+p^2)^{3/2}} = -\frac{1}{\sqrt{1+p^2}} = \int\frac{1}{r}\,dZ + C_1 = \Phi(Z) + C_1 = \cos\varphi \quad (C_1 = 0), \quad (17)$$

17_0

Card 5/15

23027
R/008/61/000/001/001/011
D237/D301

$$\frac{dZ}{dx} = \pm\sqrt{\frac{1}{\Phi^2(Z)} - 1}, \qquad (17)$$

$$x = \pm\int_{Z_{0m}}^{Z} \frac{dZ}{\sqrt{\frac{1}{\Phi^2(Z)} - 1}} + C_2 = \pm\,\psi(Z) + x_0 + qX_0 \quad (q = 0, 1, 2, \ldots, n).$$

The authors then consider the phugoids at high velocities, studying first the case of $k > 0$. Eqs. (4), (7), (16), and (17) completely define the elements of the motion. Determining φ and C_z, all other data may be obtained by simple graphical integrations, also in the most general cases. The horizontal flight at a Z^* altitude is given by the value of the constant

$$k = \frac{2}{3}\sqrt{Z^*}.$$

The point where $\frac{1}{r} = 0$, $\cos\varphi$ passes through a minimum, while the

23027

R/008/61/000/001/001/011
D237/D301

The phugoid paths of ...

corresponding altitude is given by (16). Since Z, ρ, and C_Z are always positive, the integral is also positive; if also $k > 0$, there results $\cos \varphi > 0$, $0 \leq \varphi \leq \frac{\pi}{2}$, thus the trajectory has the shape of a twisted curve, while Z varies between various altitudes Z_m, (ρ_m, a_m), given by the solutions of the equation

$$Z_m = \left[\frac{1}{2\rho^* Z^* C_z^*}\left(\int \rho \sqrt{\bar{Z}}\, C_z\left(\frac{Z}{a^2}\right) dZ\right)_{z=z_m} + k\right]^2 \qquad (19)$$

Considering that ρ does not vary, the approximative basic motion is known in these conditions, whereas the trajectory is a periodical curve with a sinusoidal aspect. The effects of the secondary order are superimposed onto this trajectory which modify the trajectory' shape. The authors then give the equilibrium equation on the vertical line, the resulting differential equation and its two expressions for subsonic velocities and supersonic velocities respectively. The solution of these equations supplies the

Card 7/15

altitude variations as a function of time. The radius of the curvature in the maximum and minimum altitude A_1, A_2, ... A_n is given by the relation

$$r = \frac{2Z_m}{\dfrac{\rho Z_m C_z\left(\dfrac{Z_m}{a_m^2}\right)}{\rho^* Z^* C_z^*} - 1}. \quad (30) \qquad (36)$$

If C_z is constant, all maximums of z are located above the $Z = Z^*$ line, while all minimums below this line. Generally, the value of the denominator varies with the altitude less than Z_m which results in the radius of the curvature having smaller values in front of the maximums than in front of the neighboring minimums. Thus, the trajectory appears more flattened at the minimum points than at the maximum ones. If the function ρC_z is continuous, the altitude $z = z_1$ ($Z = 0$) can be attained for only a constant value of $k = 0$. Around the theoretical speed of sound, C_z presents

23027

The phugoid paths of ... R/008/61/000/001/001/011
D237/D301

a discontinuity element, similar to the trajectory elements φ, r, etc. The authors then discuss the variation of the density and the lift coefficient. If C_z is constant, the speed is considerably reduced. The integral which interferes in the formulae (7), (17), and (19) can be calculated by admitting an expression for the variation of ρ:

$$\rho = \bar{\rho}\, e^{-Kz} = \bar{\rho}\, e^{-Kz_1} \cdot e^{KZ} = \rho_1 e^{KZ} \qquad (40) \qquad (40)$$

whence the integral

$$I_1 = \int \varphi \sqrt{Z}\, dZ = \rho_1 \int e^{KZ} \sqrt{Z}\, dZ =$$

$$= \frac{\rho_1}{g\sqrt{2g}} \int V^2 e^{\frac{K}{2g}V^2} dV = \frac{\rho_1}{\sqrt{2gK}} \left(V e^{\frac{K}{2g}V^2} - \int e^{\frac{K}{2g}V^2} dV \right). \qquad (41) \qquad (41)$$

is deduced. In the case of altitudes of up to 5,000 m, the relations

Card 9/15

23027
R/008/61/000/001/001/011
D237/D301

The phugoid paths of ...

$$\left.\begin{aligned} I_1 &= \bar{\rho}C_x^{\bullet}\int\frac{\sqrt{Z}}{1-bZ}dZ = -\frac{2\bar{\rho}C_x^{\bullet}}{b}\left(\sqrt{Z}-\frac{1}{2\sqrt{b}}\ln\frac{1+\sqrt{bZ}}{1-\sqrt{bZ}}\right), \\ \Phi(Z) &= \frac{\bar{\rho}}{b\rho^{\bullet}Z^{\bullet}}\left(\frac{1}{Z\sqrt{bZ}}\ln\frac{1+\sqrt{bZ}}{1-\sqrt{bZ}}-1\right)+\frac{k}{\sqrt{Z}}, \end{aligned}\right\} \quad (43) \tag{43}$$

are found, by which the motion is completely defined. For k = 0, the phugoid equation is

$$x = \pm\int_{Z_{0m}}^{Z}\frac{\left(\frac{1}{3}A+\frac{1}{5}BZ\right)Z\,dZ}{\sqrt{(\rho^{\bullet}Z^{\bullet}C_x^{\bullet})^2-\left(\frac{1}{3}A+\frac{1}{5}BZ\right)^2Z^2}} + x_0 + qX_0. \quad (46) \tag{46}$$

Using the notations $F(k_1, \varphi)$ and $E(k_1, \varphi)$ the authors then deduce the elliptic integrals of the first and second species

Card 10/15

$$\left.\begin{aligned}
x = {} & \pm\sqrt{\frac{5\rho^*Z^*C_z^*}{2B}}\{F(k_1,\varphi) - F(k_1,\varphi_{0m_1}) - 2\,[E(k_1,\varphi) - \\
& - E(k_1,\varphi_{0m_1})]\} + x_0 + qX_0, \ \text{pentru}\ \frac{5A^2}{36B} < \rho^*Z^*C_z^*, \\
x = {} & \pm\sqrt{\frac{5}{B}}\left\{\frac{5A^2}{36B\sqrt{\rho^*Z^*C_z^* + \frac{5A^2}{36B}}}[F(k_2,\varphi) - F(k_2,\varphi_{0m_2})] - \right. \\
& \left. - \sqrt{\rho^*Z^*C_z^* + \frac{5A^2}{36B}}\,[E(k_2,\varphi) - E(k_2,\varphi_{0m_2})]\right\} + \\
& + x_0 + qX_0, \ \text{pentru}\ \frac{5A^2}{36B} > \rho^*Z^*C_z^*.
\end{aligned}\right\} \quad (50)$$

(50)

At transonic and supersonic speeds, $B < 0$, while the integral is written under a slightly modified shape:

23027
R/008/61/000/001/001/011
D237/D301

The phugoid paths of ...

$$I_2 = \frac{1}{2\sqrt{-\frac{B}{5}}}\int\frac{\zeta\,d\zeta}{\sqrt{[\zeta^2-(\rho^*Z^*C_x^*)^2]\left(\zeta+\frac{5A^2}{36B}\right)}} \quad (51)$$

(51)

Using the substitution

$$\left.\begin{aligned}\zeta &= -\rho^*Z^*C_x^* + \left(\rho^*Z^*C_x^* - \frac{5A^2}{36B}\right)\sin^2\varphi\\ k_1^2 &= \frac{\rho^*Z^*C_x^* - \frac{5A^2}{36B}}{2\rho^*Z^*C_x^*};\\ \varphi_{0m_1} &= \arcsin\sqrt{\frac{\rho^*Z^*C_x^*+\zeta_{0m}}{\rho^*Z^*C_x^* - \frac{5A^2}{36B}}}\end{aligned}\right\}\text{for pentru } -\frac{5A^2}{36B} < \rho^*Z^*C_x^*, \quad (52)$$

Card 12/15

$$\left.\begin{aligned} \zeta &= -\rho^*Z^*C_z^* \cos^2\varphi \\ k_2^2 &= \frac{2\rho^*Z^*C_z^*}{\rho^*Z^*C_z^* - \frac{5A^2}{30B}}; \\ \varphi_{0m_2} &= \frac{1}{2}\arc\cos\frac{-\zeta_{0m}}{\rho^*Z^*C_z^*} \end{aligned}\right\} \text{for pentru } -\frac{5A^2}{30B} > \rho^*Z^*C_z^*. \qquad (52)$$

the authors find the equation of the trajectory for k = 0. This equation is identical with (50), if B is everywhere replaced by -B. In the case of $k < 0$, the integral I_1 from the expression cos φ (7) is always positive, since $Z > 0$. In these conditions, where $k < 0$, cos φ obtains always negative values included between - 1 and + 1. Thus, the trajectory will have on the ascending or descending branch an even number of inflection points, opposed to the cases of $k > 0$, when the number of these points is odd. Where the values

23027
R/008/61/000/001/001/011
D237/D301

$z_m \geqslant z_1$ result from Eq. (19), the trajectories no longer have the characteristic of periodicity, but in the boundary case $z_m = z_1$ $(\cos \varphi)_{z=z_1} = 1$ as shown in Fig. 4.

Fig. 4.

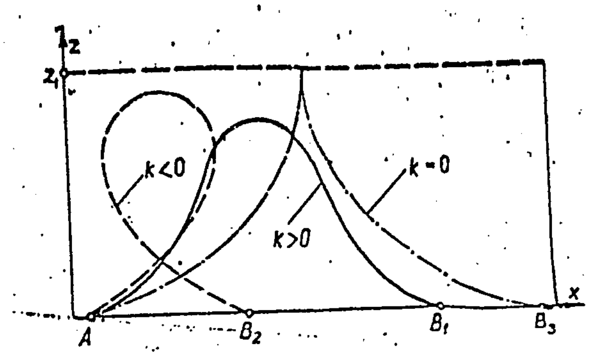

Fig. 4

23027
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D237/D301

On guarded paths of ...

The value of the k constant for this boundary case is given by

$$k_1 = \sqrt{z_1} - \frac{1}{2\rho^* z^* U^*} \left(\int \rho \sqrt{z}\, U_n \left(\frac{z}{a}\right) dz \right)_{z=z_1} \quad (5)$$

which may be positive, negative or zero, as a function of $\varphi^*(z^*)$. In all cases if $/k/ > /k_1/$ the motion is aperiodic and limited in horizontal direction by the maximum interval ΔB_1, ΔB_2 or ΔB_3. There are 4 figures and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc. The references to the English-language publications read as follows: F.W. Lanchester, Aerodonetics, London, 1906; and W. F. Durand, Aerodynamic Theory, V, I. Springer, 1935.

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Card 3/3

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24271
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D218/D301

AUTHOR: Tipei, N.

TITLE: On the motion of rockets in a resisting medium. I. Ascent of the rocket

PERIODICAL: Studii şi cercetări de mecanică aplicată, no. 3, 1961, 475-485

TEXT: The article presents the ascending motion of rockets in a resisting medium for any law of variation of the thrust and weight. The equations of the motion of a rocket in a plane trajectory were already established by the author (Ref. 1: Revue de mécanique appliquée, II, 2, 117-125, 1957). Generally, it may be considered that the horizontal displacement of the rocket during ascent in a resistant medium is not too great. Considering v to be the gas ejection velocity, the traction may be expressed by $\mathcal{T} = \frac{G_0}{g_0} kv.$ (2) Denoting ξ with and considering that $v_1 = v_{1o}$ $\xi = \frac{v_3}{v_1} = \operatorname{tg}\gamma,$ (3) in the

Card 1/5

initial moment, the author deduces from (1)

$$\left.\begin{aligned} &\int_{t_0}^{t} \frac{dt}{1-\int_{t_0}^{t} k\,dt} = \frac{G_0}{g_0}\int_{v_{10}}^{v_1} \frac{\sqrt{1+\xi^2}\,dv_1}{\mathcal{T} - \frac{\rho}{2} S(1+\xi^2)(Cx+\xi\,Cz)\,v_1^2}, \\ &v_1\frac{d\xi}{dv_1} = \frac{\frac{\rho}{2} S\,Cz\,(1+\xi^2)^{\frac{3}{2}} v_1^2 - G_0 \frac{R_0^2}{R^2}\left(1-\int_{t_0}^{t} k\,dt\right)}{\mathcal{T} - \frac{\rho}{2} S(1+\xi^2)(Cx+\xi\,Cz)\,v_1^2}\sqrt{1+\xi^2}, \end{aligned}\right\} \quad (4)$$

in which

$$\left.\begin{aligned} &R = R_0 + x_3 = R_0 + \int_{t_0}^{t} \xi\, v_1\, dt \\ &\rho = \rho_0 e^{-K(x_3 - x_{30})} = \rho_0 e^{-K\int_{t_0}^{t} \xi v_1 dt}. \end{aligned}\right\} \quad (5)$$

v_1 and t as functions of ξ may be calculated by the systems (4) and (5). Cx and Cz are given functions of the Mach number, respectively of the

24271
R/008/61/000/003/ /003
D218/D301

On the motion of rockets...

total velocity $V = v_1\sqrt{1+\xi^2}$, for every angle of attack. The height of the rocket in a certain moment is finally given by

$$x_3 = x_{30} + \frac{2\xi_0}{(1+\xi_0^2)^{\frac{3}{4}}}\sqrt{\frac{2GT}{Skk_s(\rho_0-\rho^*)}}\left\{\frac{(2\tau_3-\tau_1)k-1}{\sqrt{\tau_3-\tau_1}}\left[F\left(\arcsin\sqrt{\frac{\tau_3-\tau}{\tau_3-\tau_1}},\sqrt{\frac{\tau_3-\tau_2}{\tau_3-\tau_1}}\right)-F\left(\arcsin\sqrt{\frac{\tau_3}{\tau_3-\tau_1}},\sqrt{\frac{\tau_3-\tau_2}{\tau_3-\tau_1}}\right)\right]-k\sqrt{\tau_3-\tau_1}\left[E\left(\arcsin\sqrt{\frac{\tau_3-\tau}{\tau_3-\tau_1}},\sqrt{\frac{\tau_3-\tau_2}{\tau_3-\tau_1}}\right)-E\left(\arcsin\sqrt{\frac{\tau_3}{\tau_3-\tau_1}},\sqrt{\frac{\tau_3-\tau_2}{\tau_3-\tau_1}}\right)\right]\right\}. \quad (20)$$

The Cx coefficient drops with the Mach number according to a complicated law, variable with the rocket's shape. Generally the following relation may be admitted

$$Cx = Cx^{(0)} + \frac{K_1}{M}, \quad (21)$$

which can be approximated by the following relation:

by considering adequate values for the constants $Cx^{(0)}$ and α on the corresponding intervals, and considering more

$$Cx = Cx^{(0)} + \frac{\alpha}{M^2} = Cx^{(0)} + \frac{\alpha\bar{a}^2}{(1+\xi^2)v_1^2}, \quad (22)$$

Card 3/5

X

24271

close intervals of the Mach number. In (22), $\bar{a}$ represents the sound velocity in every point, being thus a function of the altitude x_3 attained by the rocket. The time intervals T, depend on the shape of the curve described by the moving rocket and the variation of the corresponding values. The lift coefficient is established by (32)

$$Cz = 2G_0(1-K)\frac{\frac{1}{g_0}\frac{d\xi}{dx_1} + \frac{R_0^2}{R^2}\cdot\frac{1}{v_1^2}}{\rho S(1+\xi^2)^{\frac{3}{2}}}.$$

which includes the lift proper and the effect of the $\mathcal{F}\sin\tau$ component of the total thrust. In case of a given trajectory, ξ is a value also known in every point, while Cz may be expressed by

$$Cz = c_1(x_1) + \frac{c_2(x_1)}{v_1^2}. \quad (33)$$

The author finally deduces the solution: $v_1^2 = e^{-\int A dx_1}\left(C - \int B e^{\int A dx_1} dx_1\right)$, (37)

after which Cz and the other elements of the motion result at every point. There are 2 figures and 2 references: 1 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: W. Reece, R.D. Josephe, and D. Shaffer, Ballistic

24271

On the motion of rockets... R/008/61/000/003/001/003
D218/D301

Missile Performance. Jet Propulsion, April, 215-255 (1956).

SUBMITTED: February 16, 1961

Card 5/5

ID. 6200

27420

R/008/61/000/004/001/003
D238/D304

AUTHORS: Tipei, N., and Ionescu, V.

TITLE: Study of a class of plane motions of aircraft

PERIODICAL: Studii si cercetari de mecanica aplicata, /12, no. 4, 1961, 743 - 753

TEXT: The article deals with vertical loopings flown by aircraft performing aerobatics. When studying this motion, generally it is assumed that the path is a vertical circle. This hypothesis, however, is seldom satisfied, the curve having the more general shape of a phugoid section. Starting with the general expression of the radius of the curvature

$$r = \frac{1}{\sum_{n=0}^{\infty} A_n \sin^n \frac{\gamma}{2}} + \sum_{n=0}^{m} B_n \sin^n \frac{\gamma}{2} \qquad (1)$$

4

Card 1/10

27420

Study of a class...

R/008/61/000/004/001/003
D238/D304

the authors study the path elements, deducing the equation of the path

$$r = \frac{1}{A_0}\left(1 - q\sin^2\frac{\Upsilon}{2}\right) + B_0 = r_0\left(1 - \varepsilon\sin^2\frac{\Upsilon}{2}\right). \tag{4}$$

4

in which Υ is the angle of the rate of climb, r_0 the radius of the curvature at the beginning and the end of the loop, and $\varepsilon = \frac{q}{A_0 r_0}$. The family of curves derived from the basic curve, corresponding to some values given for $A_0 = \frac{1}{r_0}$ and $q = \varepsilon$, may be easily traced with the B_0 constant, as shown in Fig. 2. The

Card 2/10

27420

Study of a class... R/008/61/000/004/001/003
D238/D304

equations of motion are given by

$$\frac{G}{2gr}\frac{dV^2}{d\gamma} = \mathcal{F} - \frac{\rho}{2} S C_x V^2 - G \sin \gamma,$$

$$\frac{\rho}{2} S C_z V^2 = G\left(\frac{V^2}{gr} + \cos \gamma\right). \qquad (8)$$

in which ρ is the air density, S the lifting surface, C_x the drag coefficient, and C_z the lift coefficient. Considering the traction to be constant as long as the engine intake does not vary, the authors deduce for a medium angle of attack, the velocity equation (12) and for small values of the angle of attack the velocity equation (14).

Card 3/10

4

27420

Study of a class... R/008/61/000/004/001/003
D238/D304

$$V^2=e^{-2\int\left(\frac{gk}{G}r+\frac{C_X}{C_Z}\right)d\gamma}\left[C+2g\int\left(\frac{\mathcal{T}_0}{G}-\sin\gamma-\frac{C_X}{C_Z}\cos\gamma\right)re^{2\int\left(\frac{gk}{G}r+\frac{C_X}{C_Z}\right)d\gamma}d\gamma\right]. \quad (12)$$

$$V^2=e^{-\int\left[\frac{4G(1+\delta)}{\pi\lambda\rho gS}\cdot\frac{1}{r}+\frac{g}{G}(\rho SC_{X_0}+2k)r\right]d\gamma}\left\{C+2\int\left[gr\left(\frac{\mathcal{T}_0}{G}-\sin\gamma\right)-\frac{4G(1+\delta)}{\rho S\pi\lambda}\cos\gamma\right]\cdot\right. \quad (14)$$

$$\left.\cdot e^{\int\left[\frac{4G(1+\delta)}{\pi\lambda\rho gS}\cdot\frac{1}{r}+\frac{g}{G}(\rho SC_{X_0}+2k)r\right]d\gamma}\cdot d\gamma\right\}.$$

4

Card 4/ 10

A better approximation may be obtained by introducing the value of r from Eq. (4) and neglecting $\sin\gamma$. In this case, the velocity deduced from (12) is expressed by:

$$V^2 = Ce^{-a_0\gamma} + 2gr_0\left(\left[\left(1-\frac{\varepsilon}{2}\right)\frac{\mathcal{T}_0}{G} - \frac{\varepsilon}{4}\frac{C_x}{C_z}\right]\frac{1}{a_0} + \right.$$
$$+\frac{1}{1+a_0^2}\left\{\left[\frac{\varepsilon}{2}\frac{\mathcal{T}_0}{G} - \left(1-\frac{\varepsilon}{2}\right)\left(\frac{C_x}{C_z}+a_0\right)\right]\sin\gamma + \left[\frac{\varepsilon}{2}\frac{\mathcal{T}_0}{G} - \right.\right.$$
$$\left.\left. - \left(1-\frac{\varepsilon}{2}\right)\left(\frac{C_x}{C_z}a_0 - 1\right)\right]\cos\gamma\right\} - \frac{\varepsilon}{4(4+a_0^2)}\left[\left(a_0 + 2\frac{C_x}{C_z}\right)\sin 2\gamma + \right.$$
$$\left.\left. + \left(a_0\frac{C_x}{C_z} - 2\right)\cos 2\gamma\right]\right). \qquad (16)$$

Card 5/10

27420

R/008/61/000/004/001/003
D238/D304

Study of a class...

and the velocity deduced from (14) by:

$$V^2 = Ce^{-b_0\gamma} + \frac{gr_0}{b_0}\frac{\mathcal{T}_0}{G}(2-\varepsilon) + \frac{1}{1+b_0^2}\left(\left\{gr_0\left[\frac{\mathcal{T}_0}{G}\varepsilon - (2-\varepsilon)b_0\right] - \frac{8G(1+\delta)}{\rho S\pi\lambda}\right\}\sin\gamma + \right.$$
$$\left. + \left\{gr_0\left[\left(\frac{\mathcal{T}_0}{G}b_0 - 1\right)\varepsilon + 2\right] - \frac{8G(1+\delta)b_0}{\rho S\pi\lambda}\right\}\cos\gamma\right) - gr_0\frac{\varepsilon}{4}\,\frac{b_0\sin2\gamma - 2\cos2\gamma}{4+b_0^2} \tag{19}$$

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After having established the velocity, formula (8) supplies the angle of attack, and the total lift or total drag, necessary for determining the wing stress. Denoting with G_a the weight of the wing and with C_x its drag coefficient, the total wing stress may be determined by (21). The wing stress thus depends on the corresponding γ angle. Expressing F_a by (22) it can be observed that the first square of this equation is almost constant.

Card 6/10

$$F_a = G\sqrt{\left[\left(\frac{V^2}{gr}+\cos\gamma\right)\frac{C_x}{C_z}+\frac{G_a}{G}\left(\frac{1}{2gr}\frac{dV^2}{d\gamma}+\sin\gamma\right)\right]^2+\left[\frac{V^2}{gr}+\left(1-\frac{G_a}{G}\right)\cos\gamma\right]^2} \quad (21)$$

$$F_a = G\sqrt{\left[\frac{\rho}{2G}SV^2\left(C_x - C_x\frac{G_a}{G}\right)+\sigma\frac{G_a}{G^2}\right]^2+\left[\frac{V^2}{gr}+\left(1-\frac{G_a}{G}\right)\cos\gamma\right]^2} \quad (22)$$

4

Thus, the maximum of F_a will approximately coincide with the maximum of the second square. The use of formulae (12) or (14), and (16) or (19), respectively, depends on the value of the angle of attack. The curve can be divided into 2 - 3 sections, onto which one may apply the polar equation or an average con-

stant value of the $\frac{C_x}{C_z}$ ratio, connecting the solution and determining at the corresponding points the value of the constant C from the velocity expression. According to the second equation of (8), the equilibrium on the path requires that the angle of attack should have at every point a value included between the maximum values, C_{zM}, and the minimum values C_{zM} of C_z. At every point of the path, the condition

$$\left.\begin{aligned} \frac{\rho S}{2G} C_{z_M} \geq \frac{1}{gr} + \frac{\cos\gamma}{V^2} \geq \frac{\rho S}{2g} C_{z_m}; \\ V^2 \geq 0, \end{aligned}\right\} \quad (24)$$

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27420

Study of a class... R/008/61/000/004/001/003
D238/D304

should be satisfied. The solution of the problem depends on the parameters $\mathcal{T}_o$ and k which depend on the engine intake. There exists thus an infinity of possible solutions, corresponding to different conditions of the engine, within the limits determined by (24). The authors finally present a calculation example showing that for the considered case, the variation of the lift coefficient C_z is small, the velocities decrease appreciably within the first part of the path and the ratio C_x/C_z may be assumed as constant. There are 4 figures and 3 references: 2 Soviet-bloc and 1 non-Soviet-bloc. The 2 references to the English-language publications read as follows: N. Tipei, C. Guta, "On the Motion of an Airplane on a Given Trajectory", Revue de mécanique Appliquée, III, 4, 393 - 403, 1958; and R. von Mises, "Theory of Flight", Mc. Graw-Hill, New York, 1945, 547 - 550.

SUBMITTED: April 21, 1961

4

Card 9/ 10

TIPEI, N., prof. ing.

Ion Stroescu, a pioneer of modern aerodynamics. Rev transport 9 no.1: 26-27 Ja '62.

R/008/62/013/003/001/006
D272/D308

14,4100

AUTHOR: Tipei, N.

TITLE: Motion of a rocket in a resisting medium. II. Ascent of the rocket. Effect of the earth's curvature

PERIODICAL: Studii şi cercetări de mecanică aplicată, 13, no. 3, 1962, 567 - 574

TEXT: General equations of motion are determined for the ascending rocket, for the case when the earth's curvature is not neglected. These equations are first solved for curved trajectories with constant slope, considering the particular cases when drag is neglected or when the thrust/weight ratio is assumed to be constant. The general equations are then solved for the case of a rocket rotating uniformly around the center of gravity, and for the case of exponential variation of the rotation with respect to time. Particular cases and initial conditions are discussed. There is 1 figure.

SUBMITTED: January 25, 1962

Card 1/1

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3,2200
24,4100

R/008/62/013/005/003/008
A065/A126

AUTHOR: Tipei, N.

TITLE: Range of ballistic rockets

PERIODICAL: Studii şi cercetări de mecanică aplicată, v. 13, no. 5, 1962, 1,091 - 1,098

TEXT: The author examines the motion of a rocket after the combustion process has ceased. The total power and thus the consumed quantity of propellant depend on the final velocity V_0 and the rocket altitude at the end of combustion z_0. The trajectory corresponds to an orbit section performed under the action of the central force, and limited at the point of intersection with the ground. This point defines also the range of the rocket. The great axis of the ellipse, described by the rocket, depends only on V_0 and z_0, while the excentricity and the small axis depend also on the launching angle θ_0. Thus, the main problem is the determination of the optimum θ_0. If the great axis of the ellipse, 2a, is smaller than the Earth's diameter 2R, plus the altitude z_0, the launching point M, the impact point N and the focal point F_2 are co-linear. This result has already been

Card 1/2

Range of ballistic rockets

R/008/62/013/005/003/008
A065/A126

deduced by J.W. Reece, R.G. Joseph and D. Shaffer (Ref. 2: Jet Propulsion, 4, 26, 1956). If, however, $2a > 2R + z_0$, the maximum range is obtained when the ellipse described becomes a tangent to the Earth's surface. In the boundary case $2a = 2R + z_0$, the points M and N, as well as the focal points F_1 and F_2 are located on a straight line. Considering that the angle θ_1 between the trajectory and the horizontal line at the impact point is given, the co-linearity of the MF_2N points allows the determination of z_0 or V_0. The author then deduces z_0 for the maximum range, as well as the relation between V_0 and z_0 and, finally, the condition which determines the maximum altitude of the end of propulsion in case of long range rockets. There are 3 figures.

SUBMITTED: June 21, 1962

Card 2/2

TIPEI, N.

Hydrodynamic lubrication of tilting pad-thrust bearings.
Rev mec appl 8 no.3:381-391 '63.

1. Corresponding member of the Academy of the Rumanian People's Republic.

APPROVED FOR RELEASE: 07/16/2001 CIA-RDP86-00513R001755810010-3"

TIPEI, N.

"Elements of cosmonautics" by Al. Stoenescu. Rev mec appl 8 no. 4: 713-714 '63.

TIPEI, N.

Effects of the mcirogeometry of surfaces on lubrication. Pt. 1. Rev mec appl 8 no. 6: 981-996 '63.

TIPEI, N.

Hydrodynamic lubrication of tilting-pad thrust bearings. Studii corc mec apl 14 no.2:279-288 '63.

TIRKI, G.

Effects of the microgeometry of surfaces in lubrication. Pt. 1.
Studii cerc mec apl 14 no.5:993-1010 '63.

1ST AND 2ND ORDERS

PROCESSES AND PROPERTIES INDEX

2ND AND 4TH ORDERS

BC

B-II-7

COMMON ELEMENTS

COMMON VARIABLES INDEX

Determination of free alkali in fats. V. TIPIKIN (Maslob. Shir. Delo, 1939, No. 1, 18).—The difference between the acid val. of centrifuged and uncentrifuged fat corresponds with the free alkali content. R. T.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

MATERIALS INDEX

AUTHOR INDEX

TIPENKO, S.

TIPENKO, S., kapitan; RADCHENKO, G., kapitan.

Carrying out exercises in maintaining the K-61. Voen.-inzh. zhur. 101 no.1:26-27 Ja '58. (MIRA 11:2)
(Vehicles, Amphibious--Maintenance and repair)

ZINEVICH, N.I., inzh.; NIKOLAYEV, A.S., inzh.; TIPER, G.D. mekhanik

Mobile metal casing. Suggested by N.I.Zinevich, A.S.Nikolaev, G.D.Tiper. Rats.i izobr.v stroi. no.9:19-23 '59. (MIRA 13:1)

1. Po materialam Alma-Atagesstroya, Alma-Ata, ul.Kalinina, d.12.
(Tunneling--Equipment and supplies)

TIPERCIUC, E., ing.

News from Rumanian enterprises; light industry. Ind text Rum 13 no.6:243-244 Je '62.

TIPEY, N.[Tipei, N.]; KONSTANTINESKU, V.N.[Constantinescu, V.N.]; NIKA, Al.[Nica, Al.]; BITSE, Ol'ga [Bita, O.]

[Sliding bearings; their design and lubrication] Podshipniki skol'zheniia; raschet, proektirovanie, smazka. Bucharest, Izd-vo Akad. Rubynskoi Narodnoi Respubliki, 1964. 457 p. Translated from the Rumanian. (MIRA 17:8)

MARKOVAC-PRPIC, A.; TIPIC, N.

New method for the preparation of arylsulphonylureas. Croat chem acta 35 no.1:73-75 '63.

1. Research Department "Pliva", Pharmaceutical and Chemical Works, Zagreb, Croatia, Yugoslavia.

MARKOVAC-PRPIC, A.; TOPIC, N.

Synthetic studies in the sulphonamide series. Pt.2. Croat chem acta 35 no.4:263-265 '63.

1. Research Department, "Pliva" Pharmaceutical and Chemical Works, Zagreb, Croatia, Yugoslavia.

VOL'KHIN, V.V.; ZOLOTAVIN, V.L.; TIPIKIN, S.A.

Effect of freezing on the properties of metal hydroxide coagulates. Part 4: Manganese dioxide coagulate [with summary in English]. Koll.zhur. 23 no.4:404-407 Jl-Ag '61. (MIRA 14:8)

1. Ural'skiy politekhnicheskiy institut im. S.M. Kirova, Sverdlovsk.
(Manganese oxide) (Particle size determination)

PROCESSES AND PROPERTIES INDEX

Progressive concentration in recycling hydrogen. V. Tipikin. —*Maslobino Zhirovoe Delo* 1935, 21 6. From math. reasoning, accumulation of H_2 in a cyclic-oil hydrogenation process follows a law of geometrical progression. Detn. of compn. of the gas mixt. after recycling the H_2 is discussed with respect to the Markman and Kalyuzhin equations, and exptl. evidence shows the importance of detg. the amt. of H_2 absorbed as a basis for control of the hydrogenation. G. Klein and A. Koluizhenko. *Ibid.* 26 8.—The Kalyuzhin and Markman equations for compn. of recycled gas in oil hydrogenations are critically discussed.

Julian F. Smith

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

Determination of free alkali in fat mixtures. V. Tipkin. *Masloboino Zhirovoe Delo* 15, No. 1, 18(1939). It is said that free alkali in hardened oils can best be detd. from the difference of the alkalimetric detn. of acid values in a sample before and after centrifuging for 3 5 min.

Chas. Blanc

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

TIPIKIN, S.V., inzh.

Use of a speed voltage generator with a ring armature for the experimental determination of the mechanical characteristics of an asynchronous motor. Izv. vys. ucheb. zav.; energ. 8 no.5:30-34 My '65. (MIRA 18:6)

1. Belorusskiy institut inzhenerov zheleznodorozhnogo transporta.

NEVOLIN, F.V., kand.tekhn.nauk; TIPISEVA, T.G., inzh.; POLYAKOVA, V.A., inzh.; SEMENOVA, A.M., inzh.

Surface-active properties and detergency of polyethylene esters of polypropylene glycols. Masl.-zhir.prom. 29 no.7:23-26 Jl '63. (MIRA 16:9)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov.
(Propylene glycol) (Cleaning compounds)

NEVOLIN, F.V., kand.tekhn.nauk; TIPISEVA, T.G., inzh.; POLYAKOVA, V.A., inzh.; SEMENOVA, A.M., inzh.; NIKISHIN, G.I., kand.khim.nauk; PETROV, A.D.

Surface-active properties and washability of solutions of sodium salts of the normal and branched fatty acids. Masl.-zhir.prom. 28 no.7:15-22 Jl '62. (MIRA 15:11)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov (for Nevolin, Tipiseva, Polyakova, Semenova). 2. Institut organicheskoy khimii AN SSSR (for Nikishin, Petrov). 3. Chlen-korrespondent AN SSSR (for Petrov).

(Acids, Fatty)
(Surface-active agents)

NEVOLIN, F.V., kand. tekhn. nauk; TIPISEVA, T.G., inzh.; POLYAKOVA, V.A., inzh.; SEMENOVA, A.M., inzh.

Surface-active characteristics and detergency of some polyethylene esters of nonyl phenols. Masl.-zhir. prom. 28 no.10:22-26 O '62. (MIRA 16:12)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov.

NEVOLIN, F.V., kand.tekhn.nauk; TIPISEVA, T.G.

Cellulose ethers and polyvinylpyrrolidinone as antiresorptive substances. Masl.-zhir.prom. 28 no.2:18-20 F '62. (MIRA 15:5)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov.
(Cellulose ethers) (Pyrrolidinone) (Cleaning compounds)

NEVOLIN, F.V., kand.tekhn.nauk; TIPISEVA, T.G., inzh.

Detergency of mixtures of synthetic cleaning compounds. Masl.-zhir. prom. 27 no. 4:38-35 Ap '61. (MIRA 14:4)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov.
(Cleaning compounds)

CHIKOV, V.M.; NEVOLIN, F.V., kand. tekhn. nauk; TIPISEVA, T.G., inzh.

Use of synthetic detergents in dishwashing. Masl.-zhir. prom. 29 no.3:36-37 Mr '63. (MIRA 16:4)

1. Leningradskiy institut sovetskoy torgovli imeni F. Engel'sa (for Chikov). 2. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov (for Nevolin, Tipiseva).

(Cleaning compounds)
(Dishwashing machines)

PETROV, A.D.; NIKISHIN, G.I., kand.khim.nauk; OGIBIN, Yu.N.; NEVOLIN, F.G., kand.tekhn.nauk; TIPISOVA, T.G.

Surface active properties and cleansing capacity of solutions of sodium salts of branched, sturated fatty acids. Masl.-zhir.prom. 26 no.8:12-15 Ag '60. (MIRA 13:8)

1. Chlen-korrespondent AN SSSR (for Petrov). 2. Institut organicheskoy khimii AN SSSR (for Petrov, Nikishin, Ogibin). 3. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov (for Nevolin, Tipisova).
(Surface active agents) (Acids, Fatty)

NEVOLIN, F.V., kand.tekhn.nauk; TIPISOVA, T.G.; YUSHKEVICH, A.V.

Effect of the composition of cleaning compounds on the quality of washed laundry. Masl.-zhir.prom. 25 no.9:29-30 '59. (MIRA 12:12)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut zhirov.
(Cleaning compounds--Testing)

BODYAZHINA, Z.I.; VENGEROVA, N.V.; GEYSHINA, K.V.; GRAUERMAN, L.A.; IRODOV, M.V.; KARANTSEVICH, L.G.; KRAL'-OSIKINA, G.A.; KUPCHINSKIY, P.D.; LEONT'YEVSKIY, K.Ye.; LITVINENKO, V.P.; LYUBCHANSKAYA, Z.I.; MAZYUKEVICH, V.A.; MAN'KOVSKAYA, N.K.; NEVOLIN, F.V.; POGONKINA. N.I.; POPOV, K.S.; PREMET, G.K.; RZHEKHIN, V.P., starshiy nauchnyy sotrudnik; SARKISOVA, V.G.; SEMENOV, Ye.A.; STERLIN, B.Ya.; TIPISOVA, T.G.; SERGEYEV, A.G., kand.tekhn.nauk, red.; PRITYKINA, L.A., red.; GOTLIB, E.M., tekhn.red.

[Technochemical control and production accounting in the oils and fats industry] Tekhnokhimicheskii kontrol' i uchet proizvodstva v maslodobyvaiushchei i zhiropererabatyvaiushchei promyshlennosti. Moskva, Pishchepromizdat. Vol.2. [Special methods in the analysis of raw material and semiprocessed and finished products] Spetsial'nye metody analiza syr'ia, polufabrikatov i gotovoi produktsii. 1959. 495 p. (MIRA 13:5)
(Oil industries) (Oils and fats--Analysis)

CODRAT, Vincenz, ing.; TIPLIC, Sorin, ing.

Reducing steel consumption by using the exothermic cast runners. Metalurgia constr mas 13 no.12:1067-1071 N '61.

COSTEA, T.; DEMA, I.; TIPLUICA, A.

Processes associated with the Szilard-Chalmers effect in crystals. II. Influence of chemical isomerism. Pt. 2. Optical isomerism. Studii cerc chim 9 no.3:533-545 '61.

1. Laboratorul de radiochimie al Institutului de fizica atomica, Bucuresti.

BUSEV, A.I., TIPTSOVA, V.G.

Analytical chemistry of thallium. Report No.5: Study of complexometric indicators for trivalent thallium. Zhur. anal. khim. 15 no.5:573-580 S-O '60. (MIRA 13:10)

1. M.V. Lomonosov Moscow State University.
(Thallium—Analysis)

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S/075/60/015/006/009/018
B020/B066

5.5200

1273, 1282 only

AUTHORS: Busev, A. I. and Tiptsova, V. G.

TITLE: Separation and Determination of Gallium by Means of Diantipyril-propyl Methane

PERIODICAL: Zhurnal analiticheskoy khimii, 1960, Vol. 15, No. 6, pp. 698-700

PROVED FOR RELEASE: 07/16/2001 CIA-RDP86-00513R

TEXT: The objective of the present paper was a systematic investigation of the applicability of gallium precipitation with diantipyril-propyl methane for separation and quantitative determination. The reagent mentioned was earlier (Ref. 2) used for the gravimetric determination of thallium in the presence of Zn, Cd, Cu, In, Al, and others, in which connection the presence of gallium did not disturb. The precipitation of Ga with diantipyril-propyl methane starts from a solution in 3 M HCl, and its quantitative precipitation takes place from 5.5 - 6 M HCl. Diantipyril methane and diantipyril-methyl methane do not precipitate Ga quantitatively from hydrochloric acid solutions. The gallium complex of diantipyril-propyl methane has the composition $C_{26}H_{30}O_2N_4 \cdot HGaCl_4$. The accuracy of analytical results is fully satisfactory (Table 1); besides, the method

Card 1/2

Separation and Determination o... ...m by Means of Diantipyril-propyl Metha..e

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is simple and does not take much time, since the precipitate is easily filtrable. The method is highly selective, since the gallium determination is not disturbed by many elements, such as Zn, Cd, Cu, Al, Ni, Mn, Mg, In, Co, Bi, and others (Table 2). Tl^{3+} and Fe^{3+} do interfere. The method can be used for separating gallium from its accompanying elements. Fe^{3+} must be reduced to Fe^{2+}. After separating gallium by complexing with diantipyril-propyl methane, the determination can be carried out by the ...metric method: the precipitate is filtered, re-washed, and th... from the filter with water. A few ml of a 5% solution of ... ammonium acetate are added to the solution up to a ... heating up to 70-80°C in the presence of 1-(2-... is titrated until the color changes from ... completely satisfactory (Table 3). Th... 1 Soviet and 1 German,

ASSOCIATION: Moskovskiy ... (Mosco...

...ITTED: ...

TIPOGRAF, D. YA.

Tipograf, D. Ia. "On the Diagnosis of Ring Rot of Potatoes," Doklady Vsesoiuznoi Akademii Sel'skokhoziaistvennykh Nauk imeni V. I. Lenina, vol. 4, no. 23-24, 1939, pp. 28-30. 20 Ak1

SO: SIRA-Si-90-53, 15 DEC. 1953